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602

Contribution from the Bureau of Animal Industry, A. D. Melvin, Chief.
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PRODUCTION OF CLEAN MILK.

Prepared in the Dairy Division.

Every owner of a dairy herd should consider it his duty to himself and to the community to keep only healthy cows, supply them

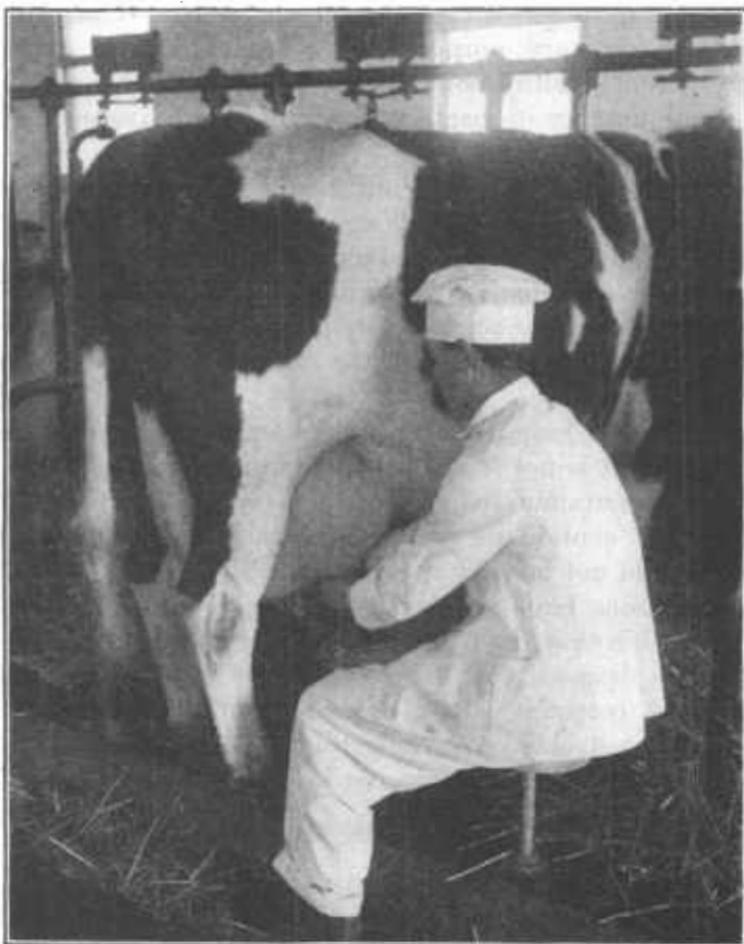


FIG. 1.—A clean milker in a clean stable at milking time. Note the clean suit, sanitary milking stool, small-top pail, cow with clean flanks and udder, and sanitary stable construction. Under these conditions it is an easy matter to produce clean milk.

NOTE.—This bulletin is intended to be of especial value to all persons engaged in the production of milk, and also to consumers who are interested in procuring clean, safe milk.

with wholesome feed and keep them in clean, comfortable quarters. He will also find it the most profitable.

The milkers and all who handle the milk should realize that they have in their charge a food which is easily contaminated; and should therefore take all reasonable precautions to prevent the milk from becoming a source of danger to themselves and others.

The consumer should understand that clean, safe milk is worth more and costs more to produce than milk which contains dirt and disease germs and should therefore be willing to pay more for it than for dirty milk, which is dear at any price.

DEFINITION OF CLEAN MILK.

While a rigid application of the definition of the word "clean" would exclude milk which contains foreign matter or any bacteria whatever, for ordinary purposes we may understand clean milk to be milk from healthy cows that is free from dirt and contains only a small number of bacteria, none of which are of a disease-producing nature.

By exercising proper care the number of bacteria which get into the milk during the process of milking is small, but these will increase rapidly if the milk is not kept cool until used.

If fresh milk contains a large number of bacteria, it indicates that the milk has become contaminated during the process of milking, although in some cases many of the bacteria may come from an infected udder.

If milk contains large numbers of bacteria when it reaches the consumer either it is not fresh, has come from a diseased cow or has otherwise been contaminated, or it has not been kept cool. Although such milk may contain no visible dirt, it is not bacteriologically clean and should not be sold as clean milk.

If milk contains large numbers of blood corpuscles or pus cells, it is an indication that the cow from which it was drawn is diseased.

Milk from a diseased cow, from one about to calve, or from one that has very recently calved possesses abnormal qualities, and though it may not always be dangerous to use, it can not be considered as clean milk and should not be used as such.

BACTERIA IN MILK.

All milk unless collected under very exceptional circumstances contains some bacteria. (Bacteria are single-celled plants so small that they can not be seen with the naked eye.) Milk furnishes all the food material and other necessary conditions for bacterial growth. The bacteria commonly found in milk grow most rapidly at temperatures between 80° and 100° F. Each bacterium at maturity divides into two and under favorable conditions the two new individuals

may become full grown and repeat the process of division in 20 or 30 minutes. At a temperature below the most favorable point the growth of bacteria is retarded, but continues slowly. Growth at 70° is rapid; at 50° it is much retarded, and at 40° or below it is very slow. Some bacteria continue to grow, however, even at the freezing point.

The rapidity with which bacteria multiply in milk, at different temperatures, is shown in Table I.

TABLE I.—*Rapidity with which bacteria multiply in milk.*

Relative growth of bacteria when held at different temperatures.					
Temperature of milk. ° F.	Number per cubic centimeter at beginning.	Number at end of 6 hours.	Number at end of 12 hours.	Number at end of 24 hours.	Number at end of 40 hours.
50 68	10 10	12 17	15 242	41 61,280	62 3,574,990

If the milk had contained 1,000 bacteria per cubic centimeter at the beginning, the part held at 50° F. would have contained 4,100 bacteria at the end of 24 hours while that held at 68° F. would have contained 6,128,000. The effect of temperature upon the growth of bacteria is shown graphically in figure 2.

Many of the bacteria commonly found in milk produce no apparent change in the milk. Others may change the flavor without changing the appearance, while some of the most common types of bacteria cause marked changes in both appearance and flavor. In this class are included the bacteria which sour the milk by converting the sugar into lactic acid and those which form a sweet curd. Another type destroys the casein and albumen in the milk and causes putrefaction and bad odors.

The number of bacteria in milk depends, first, on the number of bacteria in the udder; second, on the amount of contamination from outside sources; and, third, on the rapidity of the bacterial growth. The rate of growth depends on the temperature at which the milk is held.

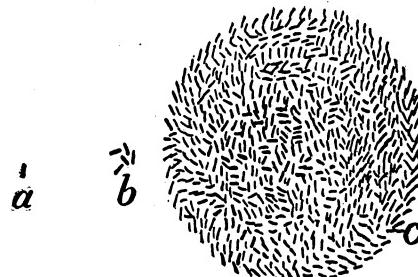


FIG. 2.—This diagram (after Conn) shows the rapidity with which bacteria multiply in milk not properly cooled. A single bacterium (a) in 24 hours multiplied to 5 (b) in milk kept at 50° F.; (c) represents the number that develop from a single bacterium kept 24 hours in milk at 70° F.

SOURCES OF MILK CONTAMINATION.

Bacteria find their way into the milk from various sources. Some may come from the udder itself, where they grow in the milk cisterns and ducts. The greater number, however, come from the dust of the air, the dirt from the udder and flanks, from the milker, and from unclean utensils. Disease-producing bacteria may get into the milk from cows having such diseases as tuberculosis, or from people who handle the milk, who may themselves have contagious diseases or who have been taking care of patients afflicted with such diseases as typhoid fever, diphtheria, and septic sore throat.

The consumer is sometimes responsible for the contamination of the milk. Milk bottles should not be taken into a sick room, because infectious diseases can be spread by carrying infected bottles back to the dairy farm. If bottles are left where there are contagious diseases, they should not be collected by the milkman until they have been properly disinfected by the board of health. In the case of typhoid fever or other serious diseases which may be carried in the milk, it is better for the consumer to put out a covered dish for the milk or have it delivered to some member of the household. Until official permission has been granted, no milk bottles should be removed from a home in which there is or has recently been a case of communicable disease. The consumer should not use milk bottles for holding vinegar, kerosene, or liquids other than milk.

IMPORTANCE OF CLEAN MILK TO THE CONSUMER.

The consumer is interested in clean milk primarily because no one cares to use a food which is not produced and handled under sanitary conditions. There is a more direct interest, however, because of the danger of contracting disease which may be communicated by this means. Serious epidemics of typhoid fever, septic sore throat, and other diseases have been disseminated through the milk supply. The weight of scientific evidence at the present time leads to the conclusion that tuberculosis may be transmitted from animals to human beings, particularly children, who consume raw milk containing tubercle bacilli.

Cleanliness is not an absolute safeguard against disease, but it is the greatest factor in preventing contamination. From the health standpoint there is great danger not only from the specific disease-producing bacteria previously mentioned, but from milk that contains large numbers of miscellaneous bacteria which may cause serious digestive troubles, especially in infants and invalids whose diet consists chiefly of milk. There is also the minor consideration of the loss to the consumer from milk souring or otherwise spoiling before it can be used. The cleaner the milk, the longer it will keep good and sweet.

IMPORTANCE OF CLEAN MILK TO THE PRODUCER.

Clean milk not only benefits the consumer, but the milk producer who will consider this subject from an unbiased standpoint will find many ways in which he himself is benefited by producing clean milk. There are a number of items in this connection which, when considered alone, may seem unimportant, yet collectively they are of great importance. Moreover, they are not only of immediate value, but have a cumulative value reaching far into the future. Tuberculin testing, for example, is not only a safeguard to the purity of the milk supply for the consumer, but is a means of assisting the producer to protect his herd against future ravages of tuberculosis.

Most producers of market milk have experienced the chagrin of having a shipment of milk refused or returned because it reached the market sour, tainted, or otherwise in poor condition. Although such milk may be used for feeding pigs it usually means a complete loss to the producer, as it costs too much to transport it back to the farm and because, depending on the market as an outlet for his milk, he has no means for utilizing small amounts at uncertain intervals. Another important consideration is the unpleasant effect upon the purchaser. Delivering sour or tainted milk usually results in losing the confidence of the dealer; or if it is delivered direct to the consumer, it means the loss of good customers. A reputation for clean milk means fewer complaints, a better class of patrons, and a steady market for the product of the dairy.

Safeguarding the purity of the milk is a protection to health on the farm in several ways; first, the health of the farmer's family, who use a portion of the milk themselves; second, the health of the calves, which live largely on milk. Healthy cows to breed from and pure milk to feed upon are two important factors in rearing thrifty calves and in the development and maintenance of a healthy and profitable herd. Aside from these immediate and definite benefits there is another consideration, not immediately measurable but of vast influence, namely, the moral influence, for no one can learn to produce good and clean milk without learning good methods of care and management of the herd, and the study of these things leads to greater care and intelligence in the economic features of the business.

THE COST OF MILK.

There has been too much indifference on the part of consumers with respect to the cleanliness of milk; too many of them desire to buy milk at a low price and do not give any consideration to quality. Dirty milk may prove expensive as a gift, while clean milk may be economical even at a high price; the cheapest article is often the most expensive. A higher price for clean milk may be a cheap insurance

against some form of sickness. It is gratifying to note, however, an increasing demand for good, clean milk. This demand has resulted in more stringent regulations concerning the sanitary conditions associated with the milk supply. Compliance with these sanitary rules requires additional care, attention, and extra expense on the part of the producer of the milk, and while this expense may not be large, it is only fair that the consumer should pay his share of the cost of improving the quality of the milk. The consumer can not expect to purchase a clean, safe milk at the same price as a dirty milk which endangers the health of his family.

A more serious consideration is the marked increase in the cost of production which has resulted in recent years from feed and labor problems. This increase is in keeping with the increase in the cost of almost every commodity, and the consumer must expect to pay his portion of any legitimate increase in the cost of production occasioned by these conditions.

On the other hand there is need of more attention to better management on the average farm devoted to the production of milk. The amount of milk produced per cow is frequently so low as to reflect seriously upon the business ability of the owner. A producer who makes no systematic effort to lower the cost of production by increasing the average production of milk per cow is entitled to little sympathy if he finds the business unprofitable. The profits yielded by a good cow often go to offset losses caused by poor cows in the same stable. The keeping of records of production of each individual in the herd, the elimination of unprofitable cows, the improvement of the herd through selection of the best producers and breeding them to a bull of dairy merit, and the selection of the best heifers from such breeding are necessary to put milk production on a sound basis. Unless the producer does these things he disregards the fundamental principles of business economy, and it is unreasonable for such a man to expect the consumer to pay him a profit on business practices which represent such economic waste. There is no good excuse for slack business methods on the dairy farm. Directions for keeping records of milk yields and cost of production are furnished by every State agricultural college and by the United States Department of Agriculture.

HOW TO PRODUCE CLEAN MILK.

THE COWS AND THEIR CARE.

To have healthy cows is one of the first essentials of the production of clean milk. If the cows are diseased their milk is apt to contain disease-producing bacteria, or be otherwise abnormal. Such milk is not clean nor safe as an article of food even though there is no visible dirt in it.

The cows should be tested for tuberculosis by a capable veterinarian at least once a year, and if diseased animals are found the herd should be tested twice a year. All cows which react, showing that they are infected with the disease, should be removed from the herd and the stable and premises thoroughly disinfected.¹ No additions should be made to the herd without subjecting all animals purchased to the tuberculin test before they are brought to the farm. They should then be kept separate from the other animals for at least 60 days and retested. Without the use of tuberculin the cattle owner is confronted with serious and continuous losses; with its use the disease can be eradicated from the herd and the danger of its spread to man from this source removed.

Special attention should be given to the condition of the udder, and any milk which appears slimy, ropy, watery, or otherwise abnormal, should not be used as food. As a rule milk should not be used within 15 days before calving or during the first 5 days after calving. It is well not to use milk from cows which have been given powerful drugs, for they may pass through the tissues of the mammary gland and into the milk.

The external condition of the cow is a most important factor in the production of clean milk. One of the greatest sources of milk contamination is the dirt on the outside of the animal's body. It is therefore essential that extra care be given to keeping the cow free from accumulations of mud and manure. Grooming is usually dispensed with as it costs money, yet there is far more reason for the daily grooming of an animal that produces human food than of a horse which hauls a manure spreader or a garbage wagon. Custom, however, demands that the horse be kept clean and this custom must be extended to include cows on farms where clean milk is produced. Cows on pasture usually keep cleaner than when in the barn, but though they appear clean they may be very dusty and should be brushed before each milking period. When kept in stables they require a thorough cleaning at least once every day. It is well to clip the long hairs from the udder, flanks, and tail, in order that dirt may not cling to them. It is desirable that the bedding be clean, dry, and used in sufficient quantities to promote the comfort of the animal, especially where the floor is of concrete.

The cow should not be groomed, bedded, or fed immediately before milking, as these operations fill the stable air with dust and bacteria. Frequent attention to the distribution of bedding is just as important as to supply a large amount of it. Often a tour through the stables the last thing at night and a few minutes' attention to the distribution of the bedding at that time will save half an hour's work of cleaning

¹ Directions for disinfecting stables are given in Farmers' Bulletin No. 480.

the cows in the morning. If the manure is daily removed a considerable distance from the stable, bad odors from it will be kept from tainting the milk, and it will diminish the danger of contamination from filth-laden flies. The fly nuisance is caused by accumulations of manure in which the flies breed, and if conditions are favorable for daily removal of manure to the fields, this should be done. Flies carry bacteria and filth, and earnest efforts should be made to keep the stable free from them. If the stable and its surroundings are clean, free from accumulations of manure and other materials which attract flies, the stable can be kept fairly free of them by the use of fly poison and traps. Good forms of fly traps are described in Farmers' Bulletins 532 and 540. In addition to removing the accumulated manure from the gutter every day, the soiled bedding from under the cow should be raked back into the gutter and replaced with clean bedding. No animals other than cows should be allowed in the stable. The open-shed system of keeping cows is advocated by many dairymen and has some advantages, but it is essential that the shed be kept dry and be open on the south side. This method is being thoroughly tested at the dairy farm of the Bureau of Animal Industry at Beltsville, Md.

The feed for cows should be palatable and nutritious. Moldy and decayed feed and such feeds as may injuriously affect the cow's health or the character of the milk should be carefully avoided. The odor and flavor of milk are very readily affected by rape, cabbage, turnips, and other feeds having strong odors, and where these are used they should be given after milking, in which case there is little danger of contaminating the milk. Where pastures are overrun with garlic or wild onion the cows should be removed from the pasture several hours before milking.

When silage first came into use as a feed for dairy cows there were many objections to it on the ground that it unfavorably affected the flavor of the milk, but these complaints are now less common, as the bad flavors have been found to be due to a poor quality of silage, improper feeding, or because silage odors were absorbed from the stable air. Good silage fed in reasonable amounts after milking will not injure the health of the cow nor impair the quality of the milk. It must be fed after milking and all uneaten silage removed so that the silage odors will disappear from the air before the next milking period. Many health authorities forbid the feeding of wet brewers' or distillers' grains to cows because the wet grains ferment rapidly and produce strong odors which are absorbed by the milk, and under ordinary conditions the stable and cows become so filthy that the production of clean milk is impossible.

Owing to the dust and odors which arise from the feeding of hay, grain, and silage, it is best, from a sanitary standpoint, to feed after

milking rather than before. A liberal supply of salt should be provided in a place where the cows can have ready access to it. It is of prime importance that the cows have an abundance of fresh, pure water. Cows which produce 25 pounds of milk a day require 75 pounds or more of water daily, and instances are on record in which heavy milkers have consumed more than 300 pounds of water a day. This large quantity of water is necessary not only for the formation of milk, but also for the digestion and assimilation of the large quantities of food consumed, much of which is roughage. It is not wise to permit cows to drink large amounts of ice-cold water, and in order to encourage them to drink a sufficient amount of water in extremely cold weather it is necessary to warm the water slightly. The water trough should be kept clean and be so situated that the cows when drinking will not be exposed unnecessarily to extremes of weather.

THE STABLE.

Whenever possible the stable should be on high ground with good, natural drainage. Poultry houses, privies, hog sheds, manure piles, or surroundings which pollute the stable air and furnish breeding places for flies should not be near the cow stable.

The silo may be connected with the stable by a feed room, but this room should be shut off from the stable by a tight door. This is convenient and also prevents silage odors in the stable except at feeding time. After the silage has been fed the stable can be thoroughly aired before the next milking period.

An ideal site for a barnyard is on a south slope which drains away from the stable. If the barnyard is inclined to be muddy, it may be improved by drainage and by the use of cinders or gravel. A clean yard is a great help in keeping the cows from becoming soiled by mud and manure.

Very few farm buildings constructed 15 to 20 years ago meet the sanitary requirements of to-day. Bank barns are generally dark and damp, as the light is often excluded from one or more sides, thus making the stable difficult to keep clean. Stables which have basements open on one side for the manure furnish a breeding place for flies. Barns which have many exposed beams, braces, and ledges on which dust may lodge are undesirable. In these old types of buildings little or no attention was paid to proper ventilation and distribution of the light. Many of them, however, can at small expense be remodeled to meet all sanitary requirements.

Construction of the barn may be less important than careful methods in handling milk when the keeping down of the bacterial content of the milk is considered, but the barn construction may be such as to lighten the labor necessary to keep the barn and its equipment in a clean condition. (See fig. 3.)

The stable should have a hard floor which can be readily cleaned; for this reason a dirt floor is undesirable. A cement floor is easily cleaned and prevents waste of the liquid manure; it is liable to be cold, however, and therefore extra bedding is required for the cows to lie on.

The gutter back of the cows should be large enough to hold the droppings; a width of 16 to 18 inches and a depth of 7 inches are usually sufficient. The gutter should incline so as to drain readily, unless the liquid is taken up by absorbents. Types of stalls and mangers are best which present the least possible surface for collecting dust and dirt, and the least obstruction to the circulation of air. Stalls of wood have many flat surfaces and cracks which are difficult to keep

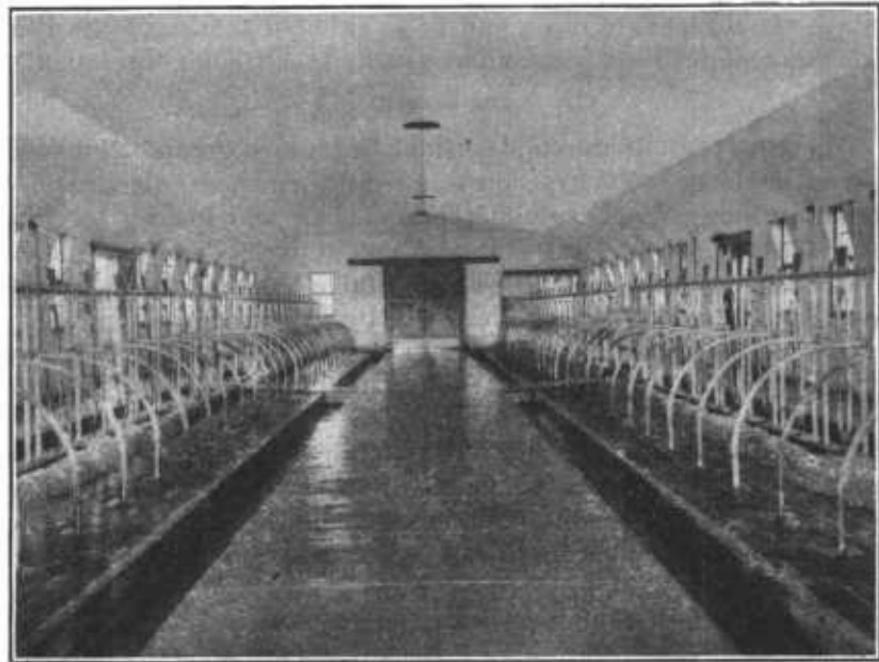


FIG. 3.—Interior of the dairy stable on the farm of the U. S. Naval Academy. The construction is such as to minimize the labor necessary to keep floor, walls, ceiling, and stable fittings in a clean and sanitary condition.

clean and in case of outbreaks of disease are not easy to disinfect thoroughly. Stalls made of metal pipes are therefore preferable. A swing stanchion is usually preferred, as it allows the cow plenty of freedom. A low, smooth manger without sharp angles is easy to keep clean. If the cows are tied, facing the center of the barn, the walkway behind them should be 5 feet or more in width so the walls will not be soiled by spattering from the gutter and the manure carrier.

The most common defect in dairy stables is a lack of cleanliness; cobwebs on the ceiling and manure on the walls are too common in such places. The dairyman must not allow cobwebs, dust, or dirt

to accumulate if he expects to produce the highest grade of milk. With a tight, smooth ceiling and smooth walls without ledges, this is not difficult. Whitewash should be freely applied at least twice a year both to walls and ceiling, as it helps to purify the stable and to keep it light. An abundance of light is necessary; 4 square feet of glass per cow is generally sufficient if the windows are well distributed and not obstructed in any way. If the stable is located with its length north and south it receives the purifying benefit of both the morning and afternoon sun.

Every cow stable should have a system of ventilation to keep the air fresh and pure and the cows comfortable without exposing them to injurious drafts. If the smell in the stable is disagreeable at any time, it indicates that the ventilation is deficient. At least 500 cubic feet of air space should be provided for each cow. Farmers who desire to provide proper ventilation in cow stables can obtain information on this point by applying to the Dairy Division.

THE MILK HOUSE.

The building in which the milk is handled should be convenient to the barn but so placed as to be free from dust and stable odors. The ideal place for it is in a well-drained spot somewhat higher than the barn. It should not be near the barnyard, pig pen, privy, or other source of contamination. In cold climates it may be connected with the stable by a covered but well-ventilated passageway with self-closing doors at each end to prevent odors passing from the stable to the milk house. With proper precautions the milk house may be in the same building as the stable, but it should be provided with a separate entrance and the walls between should be tight and without a communicating door or window.

The principal purpose in building a milk house is to provide a place where dairy products may be handled apart from all other operations. To carry out this idea it is necessary to divide the interior of the building into two or more rooms in order to wash the utensils and handle the milk in separate rooms. The milk house and all its equipment should be so planned that unnecessary steps will be avoided and labor economized to the greatest extent. A plan for the milk house shown in figure 4 is given in Bureau of Animal Industry Circular No. 195.

Thorough cleanliness must always be kept in mind; therefore there should be no unnecessary ledges or rough surfaces inside the building, so that it can be quickly and thoroughly cleaned. Milk-house floors should be of concrete and pitched to drain through bell traps. Round edges at the walls will prevent the collection of dust and dirt. The walls and ceilings may be made of matched boards but cement plaster on painted metal lathing is better. Ventilators are necessary

to keep the air in the milk room fresh and free from musty and other undesirable odors, and to carry off steam from the wash room. Windows are of prime importance, as they let in fresh air and sunlight, and facilitate work. In summer the doors and windows should be screened to keep out flies and other insects.

It is imperative that there be a plentiful supply of cold, running water at the dairy house. If it is not possible to have a gravity system the supply may be piped from an elevated tank fed by a hydraulic ram, engine, windmill, or hand pump. The dairyman can ill afford to spend his time in carrying water in a pail to cool his milk and wash his utensils. Provision must also be made for supplying an abundance of hot water to clean and wash utensils. The water supply should be clean and abundant as well as convenient;



FIG. 4.—A sanitary but convenient and inexpensive milk house built according to plans recommended by the U. S. Department of Agriculture.

otherwise the cleaning will not be thorough. Impure water is a source of contamination that under no circumstances should be allowed on a dairy farm. Outbreaks of typhoid fever in cities have been traced to dairy farms where the wash water was impure. Water which comes from shallow wells receiving surface drainage, or seepage from barnyard or house wastes or from pastures, is impure and should not be used.

UTENSILS.

All utensils which come in contact with milk should be made of durable, smooth, nonabsorbent material. Wooden utensils are hard to sterilize and therefore are not used in the best-equipped dairies. Badly battered or rusty ware is objectionable, as it is hard to clean, and contact with iron may injure the flavor of milk and milk prod-

ucts. Avoid all utensils having complicated parts, crevices, or inaccessible places which are hard to clean properly.

For the proper sterilization of utensils an abundance of steam or hot water is needed because at a few degrees above 100° F. the growth of the ordinary forms of bacteria ceases, although some exceptional forms grow at much higher temperatures. All disease-producing bacteria commonly found in milk are destroyed or rendered harmless on exposure to a temperature of 145° F. for 20 minutes. Some bacteria are able to withstand unfavorable conditions by passing into a resistant state known as spores, and these spores are killed only by long exposure to a temperature at or above that of boiling water. A pail or can may be clean to the eye and yet may carry numberless bacteria which will hasten the souring of milk, cause bad flavor in butter or cheese, or spread contagion. Milk utensils should be rinsed in cold water immediately after they have been used and before the milk has had time to dry upon them, then washed thoroughly in hot water to which soda or some washing powder has been added. Brushes are preferable to cloths for washing dairy utensils, as they are more easily kept clean and do better work.

After washing, the utensils must be rinsed and sterilized. For the latter they can be immersed in boiling water for at least two minutes or held over a steam jet for the same length of time, but the most effective method is to put them into a tight closet thoroughly sterilized with steam. The utensils while hot should be removed from the steam or water so that they will dry quickly from their own heat and until used should be kept inverted in a clean place, free from dust, flies, or other contamination. Strainer cloths can be washed in the manner above described, boiled for five minutes, and then hung in a clean place to dry.

MILKING.

Unless considerable care is taken, large numbers of bacteria may find their way into the milk during the process of milking. Cows should be milked in clean, well-lighted stables. It may be possible by taking great pains to produce good milk in a dark or dirty stable, but it is extremely improbable that clean milk will be produced under such conditions by the average person. Grooming and feeding the cattle, as well as cleaning the stable and removing the manure, should not be done just before milking, as these operations fill the air with odors, dust, and bacteria which may contaminate the milk. After grooming and before milking, the udders, flanks, and bellies of the cows should be carefully wiped with a damp cloth to remove any dust or loose hairs which might fall into the milk pail. In some dairies where milk containing an exceptionally small number of bacteria is produced, the cow's udders are washed twice in clean

water and then wiped with a clean cloth. Only those persons who are free from communicable disease should be allowed to handle milk or even enter the stable or dairy house.

After the cows are prepared for milking, each milker should thoroughly wash his hands and put on a pair of clean overalls and a jumper, or wear a suit, preferably white, which is used for no other purpose. The suit must be kept clean and occasionally sterilized with steam or hot water. It is best to use a clean milking stool to avoid soiling the milker's hands.

In modern dairies where clean milk is produced the small-top milk pail is a necessity, as such a pail presents only a small opening into which dust and dirt may fall from the air or from the cow's body. It has been found by experience that the use of the small-top pail greatly reduces the number of bacteria in milk from average dairies. Many types of milk pails are for sale, but any tinner can convert

an ordinary pail into a small-top pail by the addition of a hood, as shown in figure 5.

Milkers should be allowed to milk only with dry hands. The practice of wetting the hands with milk is a filthy habit and is liable to cause the cows' teats to chap in the winter time. Milking should be done quickly and thoroughly, with no violent

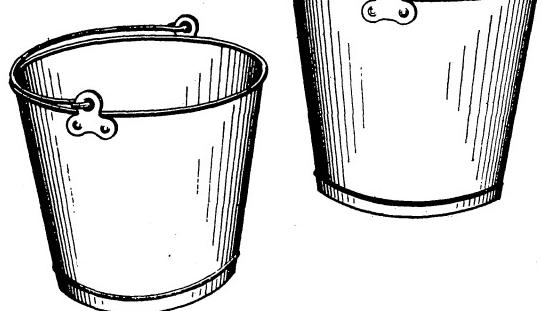


FIG. 5.—Open and small-top milk pails.

jerking of the teats. After each cow is milked the pail of milk should be removed immediately to the milk house.

The milker should remember always that he is handling a human food which is very easily contaminated. Soap, clean water, and towels must be readily accessible. The hands should be washed after milking each cow.

HANDLING THE MILK.

When the milk is taken to the milk house it should be weighed, strained, and cooled at once. The object of weighing is to keep the records of the yield of each cow so as to eliminate the unprofitable cows from the herd. All milk should be strained to remove any dirt that may have fallen into it. This is best done through a layer of sterilized absorbent cotton between two cloths, or through several

thicknesses of cheese cloth or similar material. A supply of strainer cloths should be ready for use at all times so that when one becomes soiled another can be substituted immediately. They should be treated after each milking as described on page 13.

From time to time samples of milk from each cow should be taken and tested with the Babcock tester to determine the percentage of fat. While cooling and in storage the milk cans should be kept covered to prevent the entrance of dust, dirt, insects, and other extraneous substances. Warm fresh milk should not be mixed with the cold milk of the previous milking, as such a practice results in warming up the milk which has been previously cooled.

In all cases of doubtful purity milk should be pasteurized in order to protect the consumer from dangers that might be incurred by using such milk in the raw state. Pasteurization, however, is not recommended as a substitute for sanitary precautions but as a safeguard in using milk that is not known to be pure enough to be used raw with safety.

Pasteurization is best done by heating milk for 30 minutes at a temperature of 145° F. This destroys the bacteria which cause tuberculosis and most other serious diseases, but it does not destroy all the bacteria which produce acid. The process of pasteurizing should not be confused with that of sterilizing, which means absolute destruction of all bacteria.

To retard the growth of bacteria milk must be cooled immediately to 50° F. or lower if possible. Ordinarily this can be done most satisfactorily by placing the cans in a tank, preferably concrete (see fig. 6), containing enough ice and water to come well up on the neck of the can. The cooling will be hastened if the milk is frequently stirred with a clean stirrer. Milk can be cooled more rapidly if it

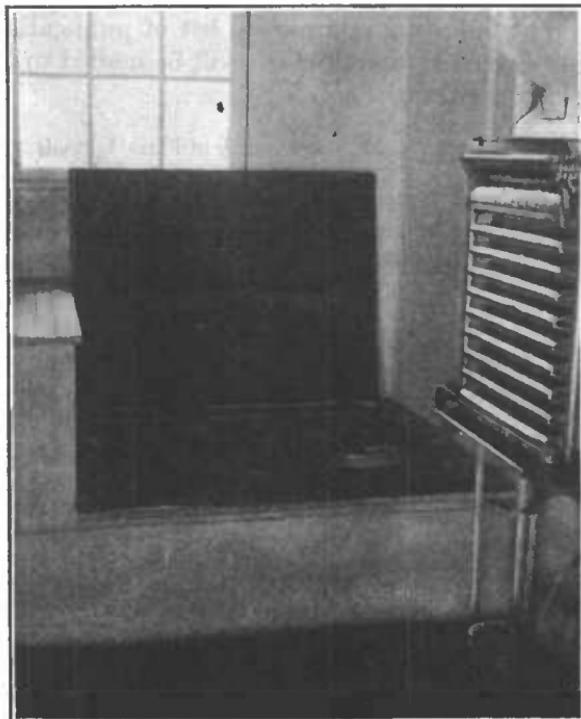


FIG. 6.—Homemade cement tank for cooling milk and cream.

is run over a cooler inside of which is cold, running water, but if the air is not pure it will contaminate the milk. The milk should be kept in ice water until it is loaded on the wagon to go to the station or receiving plant. Bottled milk may be kept cold during transportation by the use of cracked ice placed in the crates. Cans of milk must be protected from the heat of the sun by jackets or by blankets which will help keep the milk cool and in winter a covering is needed for the milk to prevent freezing.

LIST OF AVAILABLE PUBLICATIONS RELATING TO THE DAIRY.

The following is a partial list of publications which are available for distribution and which will be mailed to those who apply to the department for them:

- Farmers' Bulletin 22. The Feeding of Farm Animals.
- 55. The Dairy Herd: Its Formation and Management.
- 106. Breeds of Dairy Cattle.
- 206. Milk Fever and Its Treatment.
- 349. The Dairy Industry in the South.
- 363. The Use of Milk as Food.
- 413. Care of Milk in the Home.
- 459. The House Fly.
- 461. Concrete on the Farm.
- 463. The Sanitary Privy.
- 473. Tuberculosis.
- 480. Practical Methods of Disinfecting Stables.
- 490. Bacteria in Milk.
- 540. The Stable Fly.
- 578. The Making and Feeding of Silage.
- 589. Homemade Silos.

SCORE CARD FOR SCORING DAIRY FARMS.

The score-card system of rating dairy farms has been found to be one of the best methods of teaching dairy students the science of dairy sanitation, as all the important items are brought together in a convenient form. It is also of assistance to the dairy farmer, as it calls attention to each item of his equipment and methods separately, and thereby enables him to comply with the requirements of milk inspectors. The following is the score card used by the Dairy Division:

PRODUCTION OF CLEAN MILK.

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Equipment.	Score.		Methods.	Score.	
	Perfect.	Allowed.		Perfect.	Allowed.
COWS.					
Health.....	6		Clean..... (Free from visible dirt, 6.)	8	
Apparently in good health..... If tested with tuberculin within a year and no tu- berculosis is found, or if tested within six months and all reacting animals removed..... (If tested within a year and reacting animals are found and removed, 3.)					
Food (clean and wholesome).....	1				
Water (clean and fresh).....	1				
STABLES.					
Location of stable.....	2		Cleanliness of stables..... Floor..... Walls..... Ceiling and ledges..... Mangers and partitions..... Windows..... Stable air at milking time..... Freedom from dust..... Freedom from odors.....	6	
Well drained..... Free from contaminating surroundings.....					
Construction of stable.....	4				
Tight, sound floor and proper gutter..... Smooth, tight walls and ceiling..... Proper stall, tie, and man- ger.....					
Provision for light: Four sq. ft. of glass per cow..... (Three sq. ft., 3; 2 sq. ft., 2; 1 sq. ft., 1. Deduct for uneven distribution.)	4				
Bedding.....	1				
Ventilation.....	7				
Provision for fresh air, con- trollable flue system..... (Windows hinged at bottom, 1.5; sliding win- dows, 1; other openings, 0.5.)					
Cubic feet of space per cow, 500 ft..... (Less than 500 ft., 2; less than 400 ft., 1; less than 300 ft., 0.)	3				
Provision for controlling temperature.....	1				
UTENSILS.					
Construction and condition of utensils.....	1				
Water for cleaning..... (Clean, convenient, and abundant.)	1				
Small-top milking pail.....	5				
Milk cooler.....	1				
Clean milking suits.....	1				
MILK ROOM OR MILK HOUSE.					
Location: Free from contami- nating surroundings.....	1				
Construction of milk room.....	2				
Floor, walls, and ceiling.... Light, ventilation, screens... Separate rooms for washing utensils and handling milk.....					
Facilities for steam..... (Hot water, 0.5.)	1				
Total.....	40		Total.....	60	

Equipment + Methods = Final Score.

Note 1.—If any exceptionally filthy condition is found, particularly dirty utensils, the total score may be further limited.

Note 2.—If the water is exposed to dangerous contamination, or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0.

THE ESSENTIAL FACTORS IN PRODUCING A CLEAN, SAFE MILK.

Clean, healthy cows kept in clean, light, well-ventilated stables.
Stable so constructed as to be easily cleaned.

A clean, well-drained barnyard.

Clean utensils, thoroughly sterilized.

Clean, healthy milkers that milk with dry hands.

A small-top milking pail.

Immediate cooling of the milk to 50° F. or lower.

Storage of milk at a low temperature until delivered.

A separate house for handling the milk.

An abundant supply of pure water.

Further information concerning the production of clean milk or the planning and remodeling of dairy buildings can be obtained by applying to the Dairy Division of the Bureau of Animal Industry, Department of Agriculture.

